(12) UK Patent Application (19) GB (11) 2 148 626 A

(43) Application published 30 May 1985

(21) Application No 8426333

(22) Date of filing 18 Oct 1984

(30) Priority data
(31) 8327862 (32) 18 Oct 1983 (33) GB

(51) INT CL⁴
H01H 85/06

(52) Domestic classification
H2G EA

(56) Documents cited
GB 1523575 GB 0840655 GB 0488446
GB 1476870 GB 0514916 GB 0484782
GB 0965681
Electrical Review 1979 204 No 19 pages 6 7 & 69Proc IEE 1977 124 pages 909 to 924 especially page 910

(58) Field of search
H2G

(71) Applicant
Marbourn Limited (United Kingdom),
Oakesway Road, Hartlepool Industrial Estate,
Hartlepool

(72) Inventor
Alan Dawson Redfern

(74) Agent and/or Address for Service
Page White & Farrer,
5 Plough Place, New Fetter Lane, London EC4A 1HY

(54) Electrical fuselink

(57) An electrical fuselink in which the fuse element comprises a fuse wire of copper clad with a metal cladding for preventing oxidation of the surface of the copper and a deposit of tin or of tin-based solder located on the fuse wire. The metal cladding is preferably silver. The solder may also comprise Zn, Ag, Cd, Sb or Cu. In an embodiment the fuse element 26 is mounted between two deposits 28 of tin or tin-based solder and the deposit of solder on the wire may be omitted.

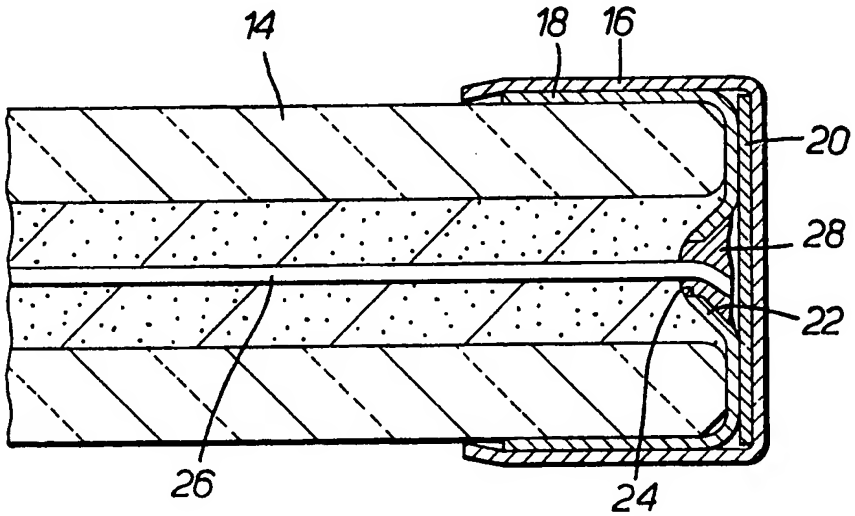

FIG. 2.

GB 2 148 626 A

1/1

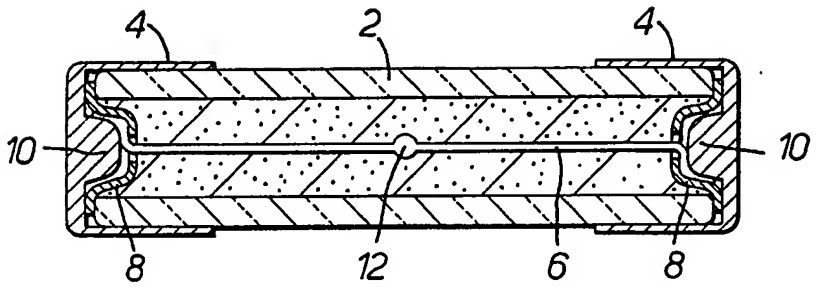

FIG. 1.

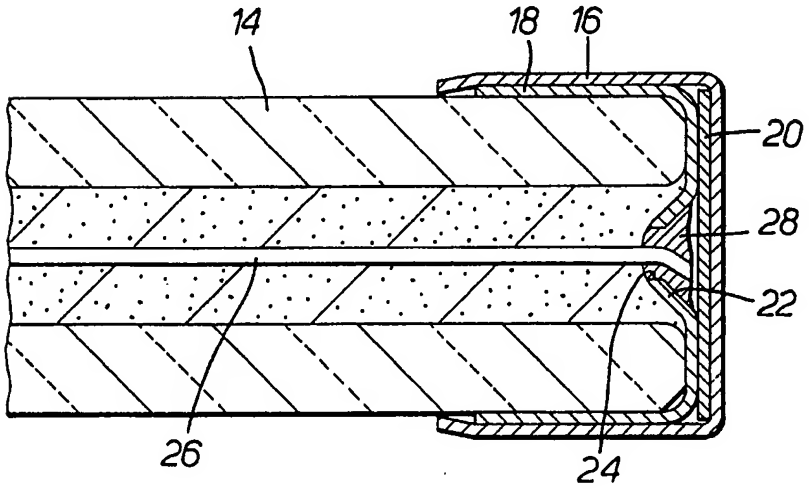

FIG. 2.

SPECIFICATION

Electrical device

The present invention relates to electrical fuselinks.

Conventional fuselinks of the high-breaking-capacity type incorporate a fuse element made of pure silver. However, the continuing increase in the price of silver has led us to investigate alternative materials for use as fuse elements but which will give at least equivalent electrical performance to the known fuselinks which incorporate fuse elements of pure silver.

Accordingly, the present invention provides an electrical fuselink in which the fuse element comprises a fuse wire or strip of copper clad with a metal cladding for preventing oxidation of the surface of the copper, and a deposit of tin or of tin-based solder located on the fuse wire or strip.

Generally, the proportion of the total diameter of the clad wire which is taken up by the cladding is at least 0.54%. Preferably the average diameter of the clad wire is 0.35–0.36 mm, preferably the thickness of the cladding is 1–2 microns, more preferably 2 microns. Preferably, the metal cladding is silver.

In a particularly preferred electrical fuse-link, the diameter of the clad wire is 0.35 mm and the resistivity of the clad wire is from 0.171 to 0.181 ohms/m.

The deposit may be composed either entirely of tin or of a tin-based solder.

Examples of suitable tin-based solders are tin-zinc alloys, tin-silver alloys, tin-cadmium alloys, tin-copper alloys and tin-antimony alloys. Typically, the tin content of the alloy is at least 70% by weight, more preferably from 88 to 97% by weight.

Electrical fuselinks incorporating fuse elements of cladded copper, as described above, are less costly than equivalent fuses incorporating fuse elements of pure silver and give an equivalent electrical performance.

Embodiments of the present invention will now be described, by way of example only, with reference to the accompanying drawings in which:

Figure 1 shows a section through a cartridge fuselink in accordance with a first embodiment of the invention, and

Figure 2 shows a section through part of a cartridge fuselink in accordance with a second embodiment of the invention.

Referring to Fig. 1, there is shown a cartridge fuselink which includes a hollow cylindrical cartridge 2 of ceramic material. The cartridge 2 is closed at its ends by metallic caps 4 which are a pressure fit on the cartridge. A fuse element 6 comprises a wire which is disposed between the end caps 4. Each end of the fuse wire is held in position by a conventional arrangement which consists of a washer 8 and a frusto-conical portion 10 formed on the inside of the end cap 4. The end portion of the fuse wire passes through an aperture in the centre of the washer 8 and is then gripped between the washer 8 and the frusto-conical portion 10 of the end cap when the fuse is assembled. A typical arrangement of this type is described in British Patent No. 1167583.

The fuselink is packed with sand of fine particle size which absorbs and dissipates the shock wave which is generated when the fuse blows.

Typically, the fuse wire in the fuselink of the present invention consists of a copper wire plated with silver to a thickness of 2 microns to give a fuse element of an overall average diameter of 0.36 mm. The wire incorporates a bead 12 of tin or a tin-based solder, the solder suitably being an alloy of 91 wt.% tin and 39 wt.% zinc. Typically, the bead of solder has a diameter of 0.6 to 1.00 mm, preferably 0.6–0.8 mm amd more preferably 0.7–0.75 mm, and is located in a central region of the fuse wire length.

The composition of other tin-based alloys suitable for use in the bead of solder are given in the Table below, in which amounts are given in weight percentages.

TABLE

TYPICAL SN-BASED ALLOYS

TIN	ZINC	COPPER	SILVER	ANTIMONY	CADMIUM
70	30	-	-	-	-
95	-	-	5	-	-
96.5	-	-	3.5	-	-
95.5	-	-	3.5	-	1
88	-	-	2	-	10
90	-	-	10	-	-
95	-	-	-	5	-
90.5	-	2.5	-	5	2

Fig. 2 shows an end of a cartridge fuselink in accordance with a second embodiment of the invention. The fuselink includes a hollow cylindrical cartridge 14 of ceramic material. The cartridge 14 is closed at its ends (only one end is illustrated in Fig. 2) by a metallic outer cap 16, which is preferably silver plated, and a metallic inner cap 18, which is also preferably silver plated. The inner cap 18 is held within outer cap 16 and on the end of the cartridge 14 by a pressure fit of outer cap 16 onto the cartridge 14. A disc 20, preferably of brass, is disposed between the inner cap 18 and the outer cap 16. At the centre of each inner cap 18 is an inwardly directed frusto-conical flange 22 having a hole 24 through the centre thereof. A fuse element 26 comprises a wire which is disposed between the two ends of the cartridge 14. The fuse element 26 is similar to that employed in the fuselink of Fig. 1. Each end of the fuse element 26 extends through a respective hole 24 and is held in position within the respective frusto-conical flange 22 by a deposit 28 of tin or a tin-based solder similar to that employed as the bead in the fuselink of Fig. 1. The deposit 28 substantially fills the frusto-conical cavity formed by the flange 22 and firmly holds the end of the fuse element 26. As in the embodiment of Fig. 1, the fuselink is packed with sand.

For the fuselink of Fig. 2, since the fuse element 26 is mounted between two deposits 28 of tin or of tin-based solder, there is no need to have a bead of tin or of tin-based solder disposed along the centre of the fuse element. However, if desired the fuse element in the fuselink of the present invention may be mounted as shown in Fig. 2 and also be provided with a deposit of tin or tin-based solder at the centre thereof.

Although the illustrated embodiments of the invention employ a fuse wire as the fuse element, it will be readily apparent to those skilled in the art that the fuse element may be a strip rather than a wire.

The invention described herein is particularly useful for use in the manufacture of miniature cartridge fuselinks of the high breaking capacity type, in accordance with British Standard No. 1362:1973, and 3, 5 and 13 amp rating.

CLAIMS

1. An electrical fuselink in which the fuse element comprises a fuse wire or strip of copper clad with a metal cladding for preventing oxidation of the surface of the copper and a deposit of tin or of tin-based solder located on the fuse wire or strip.
2. An electrical fuselink as claimed in Claim 1, wherein the solder is a tin-zinc alloy.
3. An electrical fuselink as claimed in Claim 1, wherein the solder is a tin-silver alloy.
4. An electrical fuselink as claimed in Claim 1, wherein the solder is a tin-cadmium alloy.
5. An electrical fuselink as claimed in Claim 1, wherein the solder is a tin-antimony alloy.
6. An electrical fuselink as claimed in Claim 1, wherein the solder is a tin-copper alloy.
7. An electrical fuselink as claimed in Claim 1, wherein the bead consists of tin.
8. An electrical fuselink as claimed in any one of Claims 1 to 6, wherein the tin content of the alloy is at least 70% by weight.
9. An electrical fuselink as claimed in Claim 8, wherein the tin content of the alloy is from 88 to 97% by weight.

10. An electrical fuselink as claimed in any one of the preceding claims, wherein the metal cladding is silver.

11. An electrical fuselink as claimed in any one of the preceding claims, wherein the deposit of tin or of tin-based solder is a bead of tin or of tin-based solder which is located between the two ends of the fuse wire or strip.

12. An electrical fuselink as claimed in Claim 11, wherein the diameter of the bead is from 0.6–1 mm.

13. An electrical fuselink as claimed in Claim 12, wherein the diameter of the bead is from 0.70 to 0.75 mm.

14. An electrical fuselink according to any one of CLaims 1 to 10 wherein the fuselink has two of the deposits of tin or of tin-based solder, each deposit being located at a respective end of the fuse wire or strip.

15. An electrical fuselink according to Claim 14, wherein each of the deposits acts to mount the fuse element within the fuselink.

16. An electrical fuselink according to Claim 14 or Claim 15, wherein the fuselink has a further one of the deposits of tin or of tin-based solder, the further deposit being located between the two ends of the fuse wire or strip.

17. An electrical fuselink as claimed in any one of the preceding claims, wherein the thickness of the cladding on the copper wire is at least 0.54% of the diameter of the clad wire.

18. An electrical fuselink as claimed in any one of the preceding claims, wherein the thickness of the metal cladding is 1–2 microns.

19. An electrical fuselink as claimed in any one of the preceding claims, wherein the average diameter of the clad wire is 0.35–0.36 mm.

20. An electrical fuselink substantially as hereinbefore described with reference to Fig. 1 or Fig. 2.

Printed in the United Kingdom for Her Majesty's Stationery Office, Dd 8818935, 1985, 4235.
Published at The Patent Office, 25 Southampton Buildings, London, WC2A 1AY, from which copies may be obtained.